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THE OCCURRENCE OF

INFANTILE PARALYSIS

IN MASSACHUSETTS IN 1908.

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and 8. (see page 11)

Reported for the Massachusetts State Board of Health

BY

ROBERT W. LOVETT, M.D., OF BOSTON,

AND

HERBERT C. EMERSON, M.D., OF SPRINGFIELD, MASS.

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THE OCCURRENCE OF INFANTILE PARALYSIS IN MASSACHUSETTS IN 1908.

(SECOND PAPER.¹)

BY ROBERT W. LOVETT, M.D., BOSTON.

[Reported for the Massachusetts State Board of Health.]

In pursuance of the policy inaugurated in 1907, the State Board of Health in 1908 continued the investigation into the occurrence and distribution of cases of infantile paralysis in the State of Massachusetts, with especial reference to etiology. As in the previous year, circulars were sent to all physicians asking them to report to the Board cases coming under their observation, and to physicians reporting cases blanks were sent to be filled out. From these blanks the following data were obtained.

Physicians seeing such cases were also requested to forward to Dr. Theobald Smith, pathologist of the Board, fresh specimens of stools from acute cases for bacteriological study, with reference, of course, to etiology. It is not possible as yet to state the results of these examinations. The Board has already started on the investigation of these cases for 1909, which will follow much the same lines as those of the two previous years, with especial efforts to obtain fresh stools for examination. Again the Board desires to express to the medical profession its gratitude for the most willing and helpful co-operation.

The present paper will first present a brief abstract of the literature dealing with the epidemiology of the affection appearing since the last report ("Boston Medical and Surgical Journal," July 30, 1908), and, second, an account of the features of the disease as occurring in the State in 1908. The serious epidemic which occurred in 1908 in Franklin County will be dealt with separately by Dr. H. C. Emerson, who investigated it on behalf of the Board.

¹ This article first appeared in the "Boston Medical and Surgical Journal" for July 22, 1909.

ABSTRACT OF IMPORTANT LITERATURE.

Bacteriology and Experimental Production.—The most valuable contribution of the year toward our knowledge of the disease has been made by Landsteiner and Popper of Vienna,¹ who have apparently succeeded in producing the disease in monkeys by inoculation. A boy of eight died of the disease on the fourth day. The autopsy showed typical anterior poliomyelitis. In the spinal cord and cerebro-spinal fluid there were no organisms to be found and cultures were sterile. Parts of the spinal cord were then emulsified in salt solution and injected into the abdominal cavity of rabbits, guinea pigs, mice and two monkeys. In the first three named no paralysis ensued and the spinal cords were normal.

The first monkey became violently ill on the sixth day and died on the eighth. He lay on the floor of his cage and his power to move his limbs was not investigated. After death changes typical of anterior poliomyelitis were found.

The second monkey was noted to have lost all power in the hind legs on the seventeenth day. No paralysis was present on the twelfth, although it may have been present before the seventeenth in some degree. He was killed on the nineteenth day, and again typical pathological changes were found in the central nervous system.

From the spinal cord of this monkey inoculations were made into two other monkeys, with negative results.

The conclusion of these authors is that "a so-called invisible virus, that is, one belonging to the class of the protozoa, is the cause of the disease."

With regard to the affection of domestic animals in epidemics of infantile paralysis, this was alluded to in the Rutland epidemic, reported by Caverly² in 1894 (horses and poultry). Dana investigated a hen with paralysis and found the bacteriology negative, and the changes in the cord "acute infectious softening rather than myelitis."³ It was noted by Wickman that in the Swedish epidemic of 1903 dogs were apparently affected in many instances with the children, but he was not convinced of the identity of the two affections.⁴ Free reported that pigs and chickens were affected in the Michigan epidemic, alluded to below. The attention of the State Board of Massachusetts has been called to the occurrence of infantile paralysis in a mother and daughter shortly

¹ Zeitschrift für Immunitätsforschung und experimentelle Therapie, 1909, Bd. II, heft 4, teil 1.

² Wickmann: Beitr. z. Kenntniss der Heine-Medinischen krankh. Berl., 1907.

³ N. Y. Med. Rec., Dec. 1, 1894.

⁴ Boston Med. and Surg. Jour., 1895, III., p. 14.

after an epidemic of "leg weakness" in the chickens of the household, and the matter is under investigation.

Pasteur,¹ Foullerton and MacCormac investigated the cerebro-spinal fluid of a case of poliomyelitis, finding in it mononuclear round cells. On staining, large cocci grouped in pairs and tetrads were found eleven days and four weeks after the onset of the disease. Cultures were negative. Nine rabbits were inoculated with the fluid, of which some were paralyzed after about six weeks and the cord and spinal fluid of one of these was again inoculated into other rabbits, with positive results. The inoculation from this series was negative.

Cocci which did not grow were found in the spinal fluid of affected animals, but in the one cord examined there were no changes in the ganglion cells or about the vessels. The conclusion of these authors, that anterior poliomyelitis is not the result of a specific cause, is disputed by others on the ground that the experimental paralysis is not anterior poliomyelitis (Wickman, Landsteiner and Popper).

EPIDEMICS RECENTLY REPORTED.

In Salem,² Va., and vicinity occurred between June 2 and Aug. 10, 1908, 25 cases; the neighboring city of Roanoke, seven miles distant, in close communication with Salem, escaped with 1 case. The cases all occurred in children under six, the youngest being thirteen months old. The death-rate was 12 per cent.

In September, 1908, there occurred "a number of cases" in and about Whittmore, Ia.³ The following regulation was passed by the State Board of Health of Iowa: "It is hereby ordered by the State Board of Health that all physicians and osteopaths practicing in Iowa shall promptly report to the mayor or township clerk all cases of poliomyelitis occurring in their district," etc.

In central Wisconsin,⁴ in the summer of 1908, there occurred an epidemic, with 60 cases in one of the smaller cities and 14 deaths.

In central Pennsylvania the disease was active in the summer of 1907,⁵ 100 cases having been seen in and about Dubois, and Sinkler⁶ estimated that in Philadelphia 30 per cent. more cases than usual were seen in that summer. Sinkler elsewhere⁷ speaks of the etiology as follows: "The nature and progress of the disease indicate clearly that

¹ Lancet, 1908, vol. I., 484.

² Wiley and Darden: Jour. Am. Med. Asso., Feb. 20, 1909, p. 617.

³ Iowa Health Bull., November, 1908, xxii., No. 5.

⁴ Informal communication from Wisconsin State Board of Health.

⁵ Free: Jour. Nerv. and Ment. Dis., April, 1908, p. 259.

⁶ Sinkler: *Ibid.*, p. 260.

⁷ Arch. of Diagnosis, January, 1908, p. 31.

it is due to an infection. It is obvious, therefore, that the micro-organism which produces the infection is one which is developed by hot weather. A large proportion of cases have some form of intestinal trouble. . . . It is probable, therefore, that the micro-organism producing the disease has found its entrance into the system through the intestinal tract and thence to the spinal cord."

McCombs¹ contributed a study from the Philadelphia Children's Hospital of the disease as observed at that institution between 1903 and 1907, showing 50 per cent. more cases occurring in the summer of 1907 than the sum of all cases for the preceding four years. Forty-three cases in all were analyzed.

Manwaring² reported an epidemic of 30 cases in Flint, Mich., occurring in the summer of 1908, and alluded to³ other epidemics in the State, one in Western Michigan, reported by Ostrander, and another in Chesaning.

In the Flint epidemic the average age of affected cases was ten years. Of cases under ten all lived, between ten and twenty the mortality was 25 per cent., over twenty the rate was 75 per cent., corresponding to Wickman's observations.

Griffin⁴ described an epidemic of 20 cases in Oceana County, Mich., occurring between July and September, 1907.

Twenty-nine cases were reported by Clowe⁵ as having occurred in Schenectady in the summer of 1907. There were 2 deaths in adults and 10 of the cases were seriously sick; 5 were classed as having made a complete recovery; 19 cases were less than four years old.

Partial reports⁶ of the New York epidemic of 1907 have already appeared in various articles. It seems best to wait for the published reports of the committee appointed to investigate the epidemic before analyzing the conclusions reached.

In and about Vienna, in the summer of 1908, between the end of July and October, there occurred many cases of infantile paralysis, more, according to Zappert,⁷ than had been seen since 1895. He notes the large proportion of older children to be affected, and speaks of it as a frequent occurrence in large epidemics.

¹ Arch. of Pediatrics, January, 1908, p. 36.

² Jour. Mich. State Med. Soc., April, 1909.

³ *Ibid.*, February, 1908.

⁴ Wickman: Studien über Poliom. Acuta, Berlin, 1905.

⁵ Albany Med. Jour., 1908, XXIX., p. 799.

⁶ H. W. Berg: N. Y. Med. Rec., 1908, LXXIII., p. 1; Joseph Collins: *Ibid.*, 1907, LXXII., p. 725; Terriberry: *Ibid.*, 1907, LXXII., p. 920; Jennings: Med. Rev. of Reviews, May, 1908, p. 197; Collins and Romelser: Jour. Am. Med. Assn., May 30, 1908, p. 1766; Starr: *Ibid.*, July 11, 1908, p. 112 (with list of epidemics); V. P. Gibney and C. Wallace: *Ibid.*, Dec. 21, 1907, p. 2082.

⁷ Wien. med. Wochenschr., 1908, XLVII., 2563.

An epidemic occurred in Victoria,¹ Australia, in their autumn of 1908, selecting the months of March to June. It occurred chiefly in the most densely populated suburbs of Melbourne. There were 6 deaths in 135 cases recorded, and the bacteriological findings are not sufficiently clearly given in the abstract, which alone is available, to be commented on.

Byron Bramwell² presented an analysis of 76 cases observed by him, reaching over a period of years.

One of two inferences is possible from the literature of the last year or so: either the disease is increasing rapidly in this country, or the attention of the medical profession has been called to the disease and more cases and epidemics have been recognized and reported.

CASES REPORTED IN MASSACHUSETTS.

Occurrence and Distribution.—As against 234 cases of infantile paralysis reported in 1907 only 136 cases were reported in 1908. It is interesting to note in this connection that, in 1907, 444 cases of cerebro-spinal meningitis were reported, while in 1908 there were only 183 cases. It was noted in the previous report that the two diseases, however, reached their maximum at different seasons.

In 1907 the cases of infantile paralysis in their distribution in a general way corresponded to the density of population in the State, grouping themselves as a rule about the centers of densest population, and only in and about Pittsfield, where some 28 cases occurred, was there evidence of any marked epidemic. (See map for 1907, following p. 10.)

In 1908, however, the grouping of cases was largely different, and bore slight relation to the density of population, and as a rule, where the disease was prevalent in 1907 it was rare in 1908, thus corresponding to the conclusions reached by Scandinavian investigators, that regions severely affected one year were for a while comparatively immune. As against 28 cases in the western end of the State in 1907 there were only 3 in 1908. In and about Lowell, Fall River and Haverhill there were in 1908, as in 1907, apparent slight centers of infection.

About half (69) of the cases reported in the State occurred in Franklin County, the remainder (67) being distributed through the State.

Cerebro-spinal meningitis, however, in the year 1908 showed practically the same distribution as in 1907, in general being grouped about the densest population. These comparisons are made because cerebro-

¹ H. D. Stephen: Intercol. Med. Jour. of Australasia, November, 1908; Abst. Lancet, April 3, 1909, p. 999.

² Scot. Med. and Surg. Jour., June, 1908, p. 501.

spinal meningitis is an infectious disease, apparently mildly contagious,¹ affecting many children, and manifested in the central nervous system. Presenting these points of similarity it has been thought that its characteristics might possibly in the future throw some light on the disease under consideration.

For purposes of simplicity the epidemic in Franklin County will be dealt with separately by Dr. Emerson, and in the following analysis will be considered *only* the cases occurring in the State at large. The two analyses taken together will give the occurrence of the disease in the whole State.

The *distribution* of the 67 cases may be seen in the map for 1908, accompanying this paper.

Contagion has been so carefully studied in the epidemic that it will not be dwelt on here.

Traumatism. — In 1 case a history of exposure to dampness was given, and in 9 cases histories of trauma preceding the disease. These histories, however, were in many instances vague and unreliable.

Season of Onset. — Cases occurred as follows: January, 1; February, 1; March, 1; May, 2; June, 1; July, 9; August, 11; September, 14; October, 15; November, 7; date not given, 5.

The season of onset does not differ materially from that in 1907, but does differ essentially from the season of onset in Franklin County, where it was as follows: March, 1; April, 1; June, 6; July, 28; August, 26; September, 5; November, 2.

Age. — The largest number of cases (19) occurred between the ages of one and two, and for the years from two to eight there were reported from 3 to 8 cases for each age; after this the reported cases were 1 or 2 a year up to 16. There were 2 adult cases reported, one twenty-one and one forty.

Sex. — There were 39 males, 26 females and 2 not stated.

As to other factors of possible interest in the etiology, 38 lived in detached houses and 27 in tenements, while 2 were not stated. Of the cases in tenements, 12 of the patients lived on the first floor, 10 on the second, 4 on the third and 1 in the basement. Sanitary conditions were described as excellent in 24, good in 20, fair in 16, bad in 5.

Symptoms. — In 54 cases fever was present, the temperature ranging from 100 to 104. In 1 case no fever was present. In 12 cases no record given. Brain symptoms occurred in 15 cases. There was usually delirium during the febrile state. Vomiting is recorded in 21 cases, constipation in 20 and diarrhœa in 8. Retraction of the head present in 10 cases. Pain is recorded in 46 cases, absent in 2. The pain was

¹ Edler and Huntoon: Jour. of Med. Research, June, 1909.

usually along the distribution of the paralysis and did not, as a rule, subside at once after the acute attack. Incontinence of urine and feces in 2 cases, incontinence of urine in 1, retention and later incontinence of urine 1.

Relation of Beginning of Paralysis to Onset of Fever.

Paralysis preceded the attack by two days,	1
Occurred on the same day,	5
On the next day,	6
Two days later,	11
Three days later,	13
Four days later,	8
Five days later,	4
Six days later,	1
Seven days later,	3
Eight days later,	1
Ten days later,	2
Two weeks later,	1

Complete recovery is said to have occurred as follows: —

Five days from beginning of disease,	1
Ten days from beginning of disease,	1
Two weeks from beginning of disease,	3
Six weeks from beginning of disease,	1
Three months from beginning of disease,	1

Distribution of Paralysis.

One leg,	15
Both legs,	7
One arm,	8
One arm and one leg,	11
One arm and both legs,	5
Both arms and one leg,	1
Four extremities,	6
Not stated,	14
	—
	67

Mortality. — Four cases terminated fatally, 2 dying of respiratory paralysis and 2 of exhaustion, stupor and convulsions.

CONCLUSIONS.

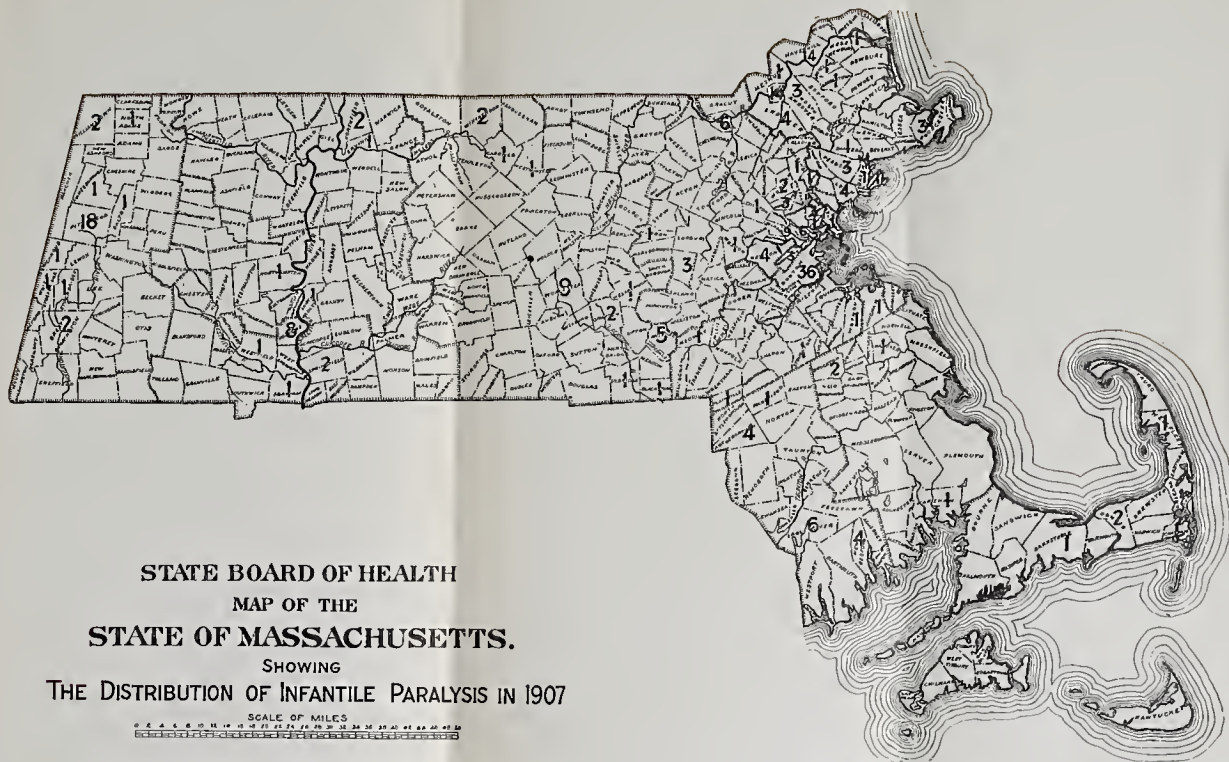
The conclusions which would seem warranted by the investigation of 1908 are as follows:—

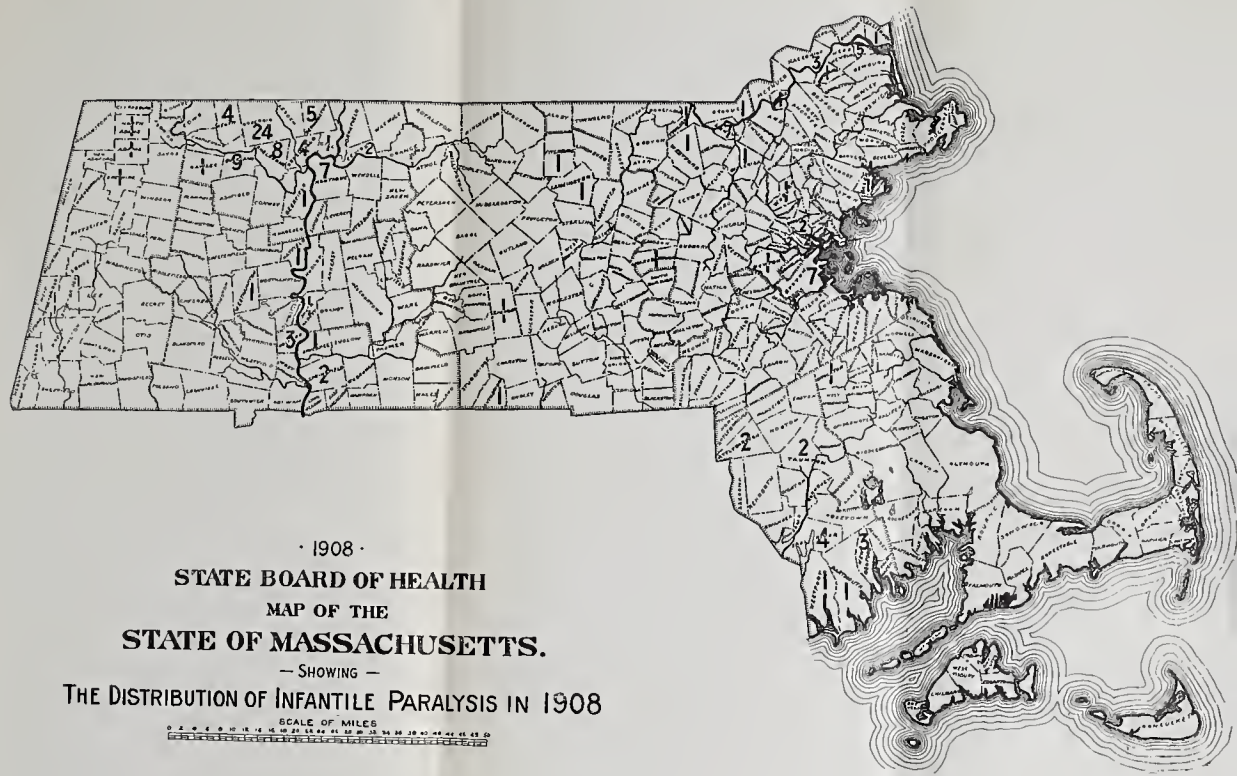
That the disease was less prevalent in the State than in 1907, as was also cerebro-spinal meningitis.

That the distribution of cases was unlike that of 1907, localities affected seriously in 1907 largely escaping in 1908. That this is quite the opposite of the almost identical distribution of cerebro-spinal meningitis in the same two years.

That half of the cases occurring in the State were comprised in an epidemic in Franklin County.

Finally it may be stated that it is not to be expected that any material light will be thrown on the etiology of the disease by its observation during any one year, but it is hoped that by a study of the disease for a period of years in the same territory, conclusions of value may be established. It is also to be hoped that by the study of the stools of fresh cases some light may be thrown on the etiology.





8.

AN EPIDEMIC OF INFANTILE PARALYSIS IN WESTERN MASSACHUSETTS IN 1908.¹

BY HERBERT C. EMERSON, M.D., SPRINGFIELD, STATE INSPECTOR OF HEALTH,
DISTRICT 14.

[NOTE:—The following investigation of this epidemic was made at the suggestion of Dr. Henry P. Walcott, chairman of the State Board of Health. The information was obtained through the courtesy and assistance of the physicians, which enabled the writer to visit the homes of all the cases reported in this epidemic. The writer spent a month living in the towns in which the epidemic occurred, and made several subsequent visits to these places.]

Sixty-nine cases of infantile paralysis, or approximately one-half the total number reported in the State during 1908, occurred in western Massachusetts, and were distributed as follows:—

Colrain,	24	Erving,	2
Buckland,	9	Adams,	1
Shelburne Falls,	8	Cheshire,	1
Montague,	7	Deerfield,	1
Bernardston,	5	Gill,	1
Greenfield,	4	North Adams,	1
Heath,	4	West Hawley,	1

GEOGRAPHICAL DISTRIBUTION.

Three isolated cases occurred in the extreme northwestern part of the State in three contiguous towns, viz., Cheshire (August 7), Adams (August 16), North Adams (November 3). The remaining 66 were distributed throughout a group of eleven neighboring towns in the western part of the State, south of the Vermont State line. The territory involved is a sparsely settled hill country, with numerous streams furnishing water power for various manufacturing interests. The communities are largely agricultural, with a considerable factory population in the larger towns. Most of the cases occurred in the valley of the Deerfield

¹ An abstract of this article first appeared in the "Boston Medical and Surgical Journal" for July 22, 1909.

River (Shelburne Falls-Buckland) and that of its main feeder the North River (Colrain), and at that point on the Connecticut River (Turners Falls), where the Millers and Falls rivers empty into it. As both the valleys of the Deerfield and North rivers are very narrow the bulk of the population lives naturally very near these streams.

Twenty-four cases occurred in Colrain (population 1,800), a town of five villages, containing three cotton mills, in the narrow North River valley. Nine of these cases occurred in Griswoldville (population 350), the largest of the three mill villages. Seventeen cases occurred in the village of Shelburne Falls, a manufacturing town with a population of 2,500, which includes the villages of Shelburne Falls and Buckland, which are separated by the Deerfield River only. Six cases occurred in Turners Falls, a large manufacturing town on the Connecticut River, and 2 cases were in other towns across the river. The other cases were distributed in neighboring small towns.

Fifty-two of the 66 cases were located in the valley on these streams, while 10 of the remainder were hill cases in country districts adjacent to these towns. There were 3 scattered cases in Greenfield. The distribution of the cases is as follows:—

On the North River,	23
Hill cases adjacent,	5
On the Deerfield River (Shelburne Falls-Buckland),	13
Hill cases adjacent,	4
On the Falls River,	6
On the Connecticut River,	5
On the Connecticut River canal (Turners Falls),	2
On the Millers River,	2
Hill case adjacent,	1
On the Deerfield River (Deerfield),	1

The actual distance from the houses where the cases occurred to these streams above mentioned, including millponds, canals, etc., was found to be as follows: 4 cases were one-quarter of a mile distant; 15 cases were one-eighth of a mile distant; 33 cases were less than 500 feet distant, of which 20 cases were from 10 to 200 feet distant.

The relation of the hill cases to those in the valley was noted, and in every case it was found that the hill cases gave a history of visiting, driving or in some way spending time in the nearby towns, which were upon the streams, as above mentioned. A trolley line runs through the North River valley connecting Colrain and Shelburne Falls, and there is also trolley connection between Greenfield, Turners Falls and Millers Falls. Transportation for the hill cases to the river towns was by wagon

only. It may be stated that there was no case in the 66 under consideration which had not been exposed recently to the valley influences, if any.

In addition to the above 69 cases in western Massachusetts, 6 cases of infantile paralysis occurred in southern Vermont in territory contiguous to the Colrain district. They all appeared to be independent cases, and 4 of them were located near the Deerfield River or its branches.

SEQUENCE OF CASES.

Sixty-five of the cases occurred in the summer months, as follows: June, 6; July, 28; August, 26; September, 5; while isolated cases occurred in March, 1; April, 1; and in November, 2. The height of the outbreak appears to have been July 25, on which date 6 cases occurred in 4 towns, as follows: Bernardston, 2 (one family); Buckland, 2; Shelburne Falls, 1; Colrain, 1. The early cases occurred at various points throughout the district concerned, as follows: in Turners Falls district June 4 (the earliest case), in the Shelburne Falls district June 20, in the Colrain district July 1 (in the southern part of this territory) and July 4 (in the northerly part of this section).

The following table shows the sequence of cases as to time of onset:—

Date.	Town.	Case Number.
March 25,	Heath,	39x
April 1,	Heath,	39
June 4,	Montague (Turners Falls),	1
June 9,	Montague (Turners Falls),	2
June 13,	Montague (Turners Falls),	3
June 17,	Greenfield,	11
June 20,	Shelburne,	26
June 27,	Shelburne,	27
July 1,	Colrain (Shattuckville),	45
July 2,	Montague (Turners Falls),	4
July 4,	Colrain (Willis Place),	60
July 5,	Gill,	10
July 6,	Montague,	5
July 7,	Colrain (Frankton),	40
July 9,	Greenfield,	13
July 11,	Colrain (Griswoldville),	49
July 16,	Colrain (Frankton),	41
July 16,	Colrain (Shattuckville),	43
July 17,	Colrain (Shattuckville),	44
July 18,	Colrain (Griswoldville),	50
July 19,	Colrain (Griswoldville),	53
July 20,	Shelburne Falls,	25
July 20,	Montague,	6
July 20,	Colrain (Griswoldville),	51
July 23,	Colrain,	63
July 23,	Bernardston,	17
July 24,	Buckland,	29
July 25,	Shelburne Falls,	23
July 25,	Buckland,	32
July 25,	Colrain (Frankton),	42
July 25,	Buckland,	36
July 25,	Bernardston,	15
July 25,	Bernardston,	16
July 27,	Colrain (Griswoldville),	54
July 29,	Colrain (Willis Place),	59
July 29,	Shelburne Falls,	22
Aug. 2,	Colrain (Griswoldville),	56

Date.	Town.	Case Number.
Aug. 3,	Colrain (Shattuckville),	47
Aug. 3,	Colrain (Shattuckville),	46
Aug. 5,	Colrain (Griswoldville),	48
Aug. 7,	Greenfield,	14
Aug. 7,	Cheshire,	64
Aug. 7,	Colrain (Lyonsville),	61
Aug. 8,	Buckland,	28
Aug. 9,	Greenfield,	12
Aug. 11,	Bernardston,	18
Aug. 11,	West Hawley,	67
Aug. 12,	Colrain (Griswoldville),	57
Aug. 12,	Montague,	7
Aug. 12,	Buckland,	30
Aug. 15,	Buckland,	35
Aug. 16,	Adams,	66
Aug. 18,	Erving (Millers Falls),	8
Aug. 22,	Shelburne Falls,	24
Aug. 23,	Heath,	37
Aug. 23,	Shelburne Falls,	21
Aug. 23,	Shelburne Falls,	20
Aug. 23,	Colrain (Willis Place),	58
Aug. 24,	Colrain (Adamsville),	62
Aug. 24,	Colrain (Griswoldville),	55
Aug. 27,	Colrain (Griswoldville),	52
Aug. 29,	Buckland,	31
Sept. 4,	Bernardston,	19
Sept. 8,	Deerfield,	14x
Sept. 23,	Buckland,	33
Sept. 25,	Buckland,	34
Sept. 29,	Heath,	38
Nov. 3,	North Adams,	65
Nov. 6,	Erving (Millers Falls),	9

From this table it appears that the outbreak in the various towns, with the exception of a few small groups, was not an explosive one, but cases occurred from time to time, covering a period of from six to eight weeks in each town. The sequence of cases in groups is shown in detail under "Contact and Relation of Cases."

CONTACT AND RELATION OF CASES TO EACH OTHER, TAKEN UP BY GROUPS.

Turners Falls Village.—The first cases out of the whole number occurred in Turners Falls Village on June 4, 9 and 13. These cases came down five days apart, and it is probable that there was indirect contact between the three families, although the contact between these 3 cases was very slight, if any. Case No. 1, June 4, was near the middle of a thirty-tenement block, and was the only case in the block or on the street. Case No. 2, June 9, was on the next street, in a four-tenement house, while Case No. 3, June 13, was in the middle of a thirty-tenement block next to the tenement house just mentioned. Case No. 1 was certainly an independent case, and probably case No. 3, while case No. 2 may not have seen case No. 1.

Independent case. 1. Contact cases, 2.

Turners Falls Suburbs. — Cases No. 11, June 17, No. 4, July 2, No. 10, July 5, and No. 5, July 6, were all independent cases, and were scattered in the suburbs of the village of Turners Falls, 3 being in Turners Falls, 1 in Greenfield and 1 in Gill, all within a mile and a half circle. Case No. 6, July 20, was a cousin of case No. 5, and lived on the second floor of the same tenement. These families were intimate, but as the children were five and eight months old, respectively, they were kept in their carriages, and there was no intimate contact between them.

Independent cases, 4. Contact case, 1.

Greenfield-Deerfield. — Case No. 13, July 9, No. 14, August 7, and No. 12, August 9, were all independent cases in Greenfield, one-half to one mile apart. No. 14x, September 8, was also an independent case, living in Deerfield.

Independent cases, 4.

Bernardston. — Two cases occurred at the same time in one family, Nos. 15 and 16, July 25. At the same time an older brother of nineteen, case No. 17, came home from logging with a headache, and went to bed and was supposed to have typhoid fever. His history and the atrophy of muscles in his right hand showed that he had infantile paralysis. A mile above this house was case No. 18, August 11. Three weeks later, September 4, a brother, case No. 19, was taken ill, having been, of course, in close contact with case No. 18.

Independent cases, 4. Contact case, 1.

Shelburne Falls. — The first case, No. 26, in this group was a primary case, and occurred June 20 on a mountain farm four miles from Shelburne Falls. There was intimate contact with a brother of fourteen and a sister of two, but not with a brother of twenty-two, who was working hard haying. Seven days later, however, he was taken sick, case No. 27, June 27. Cases No. 25, July 20, No. 23, July 25, No. 22, July 29, and No. 20 and No. 21, taken ill on the same day, August 23, were all independent cases. No. 20 and No. 21 had been more or less intimate up to the time of illness. Case No. 24, taken sick August 22, was visiting in Shelburne Falls and went daily across the river to a cousin in Buckland who was sick, case No. 36.

Independent cases, 6. Contact cases, 2.

Buckland. — Case No. 29, July 24, living on a mountain two miles from the village, was an independent case, as were cases No. 32, July 25, No. 36, July 25, No. 30, August 12, No. 31, August 29, and No. 33, September 23, living in the village. Within a day or two of the onset of case No. 33, his brother, case No. 34, was taken sick. As the history was difficult to get it cannot be stated whether his illness was

coincident or a day or two later. Case No. 28, August 8, had been in contact with case No. 36, living two doors above, and was taken sick two weeks later.

Independent cases, 6. Contact cases, 2.

Colrain. — This town lies about one mile above Shelburne Falls and consists, as previously stated, of five villages: Frankton, Shattuckville, Griswoldville, Willis Place and Colrain City in the narrow North River valley. The largest number of cases was in the middle settlement, Griswoldville, and there were none in the settlement farthest north, Colrain City.

Frankton. — The Frankton group, consisting of three cases, Nos. 40, 41 and 42, had their first symptoms nine days apart, July 7, 16 and 25. These cases lived in three houses, about seventy-five feet apart. The first case, No. 40, was independent. No. 41, a child of two, had been carried by its mother when she went to inquire for No. 40, but there was no intimate connection between the children. There was an indefinite history of commingling of all the children, and No. 43 may have been in the house of No. 42 while she was ill. No. 43 was, however, recovering from a severe burn, and it is not probable that she was with the other cases while she was sick.

Independent case, 1. Contact cases, 2.

Shattuckville. — About one mile above Frankton occurred 6 cases 2 of which, No. 43 and No. 44, were in one family and were coincident, July 16 and 17. Two others, No. 46 and No. 47, were coincident cases in another family, August 3. No. 45, July 1, was an independent case, as was No. 48, taken ill August 5.

Independent cases, 6.

Griswoldville. — From one-half to a mile above Shattuckville is the village of Griswoldville, consisting of one street in a very narrow valley. Nine cases occurred here, of which No. 49, July 11, No. 50, July 18, No. 53, July 19, No. 54, July 27, No. 56, August 2, No. 55, August 24, and No. 52, August 27, were probably independent cases, there being no history of contact of these children with each other while ill. Case No. 51 had played a little with case No. 50, but had not seen her after she, No. 50, was taken sick, and she may be considered an independent case, being a member of the family of the owner of the mills and knowing none of these other children. Case No. 57, however, a girl of sixteen, had been taking care of case No. 56, her sister of six, and was taken sick ten days after her younger sister.

Independent cases, 8. Contact case, 1.

Willis Place. — About a mile above Griswoldville is a large twenty-seven-tenement block. At one end of this block case No. 60 was taken

sick July 29 and case No. 58 at the other end of the block August 23. There was no visiting between these families after the first case was taken sick and they appear to be independent cases.

Independent cases, 3.

The 54 cases just reviewed constitute what may be called the group cases, of which 43 are independent and 11 are possible contact cases,—7 of which are of known and 4 of possible contact. The 15 remaining cases are all independent, 9 of which are connected by location with the groups above mentioned and 6 are isolated.

Independent Cases.

Group,	43	
Connected with the group,	9	
Isolated,	6	
	—	58

Contact Cases.

Known,	7	
Possible,	4	
	—	11

Total,	69
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Two cases in same family, coincident,	3
Three cases in same family, coincident,	1
Two cases in same family, not coincident,	4 ¹

TIME INTERVAL.

The time interval elapsing between the exposure and onset of symptoms of the 7 cases of known contact is as follows: 3 cases of intimate contact with intervals of twenty-four days, fourteen days and eight days; 4 cases of contact not intimate, fourteen days, nine days (two instances) and seven days. In the 4 cases of probable contact the history is too indefinite to make it worth while to estimate this time interval.

EVIDENCE OF CONTAGION.

The following are the facts in relation to the 7 cases of known contact: case No. 6 was a female infant of five months, one of three children living in an upper tenement. She was taken ill fourteen days after her cousin, a female infant of eight months, was attacked who lived on the first floor of the same house. It is known that the infants were in the

¹ One of these consisted of two families, married sisters, living on the first and second floors of same house.

same room during the illness of the one first affected, but they were not in the same carriage or together on the same bed. Case No. 19 was a ten-year-old brother of case No. 18, and was taken sick twenty-four days later. There was no isolation, and two boys in the family were more or less intimate with the sick one. Case No. 24 shows the most intimate contact of any. She was a fifteen-year-old girl, and came to see her cousin, a boy of two, every day. She took care of him, sat by him and kissed him. Her first visit to him was three weeks after he was taken sick, when the acute symptoms had disappeared. Her first symptoms began eight days after she had first seen him. Case No. 27 was a strong farmer lad twenty-two years old. He was taken sick one week after his brother of four years. This boy was kept in the living rooms, and was intimate with two small children, but there was no intimate contact between him and the older brother, as he was very busy haying. Case No. 28, a girl of ten, lived two doors from case No. 36, a child of two years, and was a frequent visitor to this child, but she did not kiss him. Her first symptoms began fourteen days after the onset of symptoms in the little boy. Case No. 41 had been taken in its mother's arms when she went to inquire for the first case in this group, case No. 40, and may have been in the house several times, but there was no very intimate contact between them. She showed signs of the disease nine days after the onset of case No. 40. Case No. 57 was a girl of sixteen who had been taking care of her sister, No. 56, and had been sleeping with her throughout her illness. Her first symptoms were ten days after the onset of the first case in the family.

EVIDENCE OF NONCONTAGION.

Out of the whole number of cases there were but 2 that were isolated during their illness. One was in a family in which there were no other children and 1 was in a house in which there were three children, and this case was as thoroughly isolated as if it were a case of scarlet fever. The remaining 67 cases were not isolated in any degree, except that in a few instances the serious illness of the child was a sufficient bar to any intimate contact with the other children in the family.

Careful inquiry into the conditions that obtained during the illness of the 67 in which there was no isolation shows that there were 166 children in these families, 4 of which later had the disease; that there were 4 instances in which the sick child slept with a brother or sister up to the time of illness, 7 during the first few days of illness and 5 throughout the entire illness; that there were 9 instances in which the other children of the family drank from the same cup; that there were 12 instances in which the children in the family and neighbors' children

kissed the sick child during the acute illness. It is impossible to determine the number of times that contact of the kind just mentioned occurred, but the above detail indicates to how great an extent the intimacy of the well with the sick did occur. Out of the entire number involved in the intimate contact just described 2 cases developed the disease.

Investigation further showed that there were, in addition to the 166 exposed children in the families, 86 children among neighbors and friends (making a total of 252 children) who were in intimate contact with the 67 cases. By intimate contact is meant (and this appeared to be almost universal) as free intercourse of the well and the sick as the patient's condition would permit. Playing with the child, sitting beside him and taking naps lying on the lounge or bed with him were the conditions that existed in almost every case. The total number of children that were more or less intimately exposed to the 67 cases is probably at least twice or three times the number of known exposures.

DIET.

Investigation of the diet showed the following: general diet, 58; cow's milk exclusively, 4; breast milk and cow's milk, 3; breast milk and fruit, etc., 4. Milk was found to be used in considerable quantities by 29 cases, in small amounts by 26, while 3 cases used no milk at all. Nineteen families produced their own milk, and there were twenty-two milkmen serving thirty-six families, while the milk for the remainder of the cases was brought from various sources. None of the infants under one year of age were fed upon breast milk alone.

UNUSUAL DIET.

It was not found possible to get a more detailed history of the diet than is given above, except that in 6 cases it was especially mentioned that fruit and berries had been a very large item of diet. In the 2 infants, five and eight months old, bananas and berries were given as the diet in addition to breast milk. In 1 case the illness was attributed to eating heartily of English mulberries, and in 3 cases to the eating of large amounts of blackberries and blueberries. In 39 instances it was stated that food supplies were bought from pedlars, and it was found that these carts frequently served the town and country districts in their localities.

PRECEDING ILLNESS.

Practically all the cases had been in good health previous to this attack. One child was in very feeble health, 5 were in a more or less run-down condition and 63 were in their usual condition, or good health. (One had recovered two months before from a slight attack of scarlet fever.)

CONDITIONS IMMEDIATELY PRECEDING ONSET.

Traumatism. — There were 3 cases of traumatism as follows: fall from bicycle three weeks before illness; fall from piazza four weeks before illness; burn of arm and chest three weeks before illness. There were no special symptoms subsequent to the two falls, and the burn was healing properly when infantile paralysis developed.

Overheating. — Five cases gave a history of possible overheating within a day or two of the onset of the disease.

Fatigue. — Four cases were noted as suffering from marked fatigue within a day or two of this illness. One was a child of seven, who had been carrying bricks up a ladder the day before he was taken ill; another was a young man of eighteen who was a noted athlete; a third had been lifting very heavy weights, and a fourth was tired out with school work.

Swimming. — Five cases had been in swimming in the streams near by and 6 cases, among children, had been playing in the brooks, ponds, etc.

One child had a severe cold just before the symptoms of this disease appeared. It was noted in one case, in a young man of nineteen years old, that he had been extremely nervous and very much worried for fear he would develop this disease, as he had recently attended a funeral of a classmate who died from infantile paralysis.

ABORTIVE CASES.¹

There were 6 cases reported which on investigation were found to have the same acute symptoms as the other cases, but to a less degree, and no paralysis occurred. The history of these cases seemed to eliminate the possibility of their being simple gastro-intestinal disturbances; and while the diagnosis of infantile paralysis cannot be proven, the history of the cases seemed to warrant their being considered as abortive cases of this disease. One case occurred in a family more than three weeks after the onset of a rather severe case in another brother. One case was coincident (doubtful history) with that of an older brother, while 4 cases occurred without known exposure.

¹ This type of the disease is recognized and described by Wickman.

SYMPTOMS ACCOMPANYING ATTACK.

Pain, more or less marked, 62 cases; pain, little or none, 7 cases; fever, 63 cases; constipation, 47 cases; diarrhœa, 2 cases; nausea and vomiting, 43 cases; retraction of head, 35 cases; retention of urine, 23 cases; incontinence of urine, 1 case; brain symptoms, 13 cases; stiffness of neck, 6 cases; stiffness of spine, 7 cases.

ONSET.

The onset in 65 cases was sudden and in 4 cases it was delayed, extending over several days.

COMPLICATING SYMPTOMS.

In 1 case a marked urticaria was an initial symptom; in 2 cases intense pain in the stomach was noted, also, as an initial symptom; in 5 cases a complicating tonsilitis was present; in 1 case a severe nose bleed took place; an extremely offensive breath was noted once; double vision occurred once as did also marked disturbance of speech. The early symptoms in 1 case were thought to be due to swollen glands, which had been present for a year, and in another case to a rheumatic condition. In 2 cases stumbling of the child while walking and playing was one of the first symptoms noted.

DIAGNOSES MADE.

In 1 case no diagnosis whatever was made; in 2 cases a diagnosis of typhoid fever was made, and the following diagnoses of single cases: digestive disturbance, heat stroke, cerebro-spinal meningitis, rheumatism.

RECOVERY.

Excluding the 6 abortive cases, 58 cases were examined in this regard about nine months after the illness. Six cases appeared to have completely recovered from the paralysis. Six others appeared to have recovered, but of these, 5 were infants and could not be satisfactorily examined, while the other was sick at the time of examination. These 6 cases were classed as apparent recovery. Forty-two cases had partially recovered from paralysis, while 4 cases had shown but very slight improvement since the attack.

DEATHS.

There were 5 fatal cases, 1 of which made a partial recovery and died two months later of broncho-pneumonia. The length of the illness in

days was as follows: female, eight months, 65 (broncho-pneumonia); male, three years, 6; female, four years, 4; female, fifteen years, 5; male, nineteen years, 6.

AGE AND SEX.

Forty-two were males and 27 were females. This epidemic was characterized by the number of cases in middle and late childhood and young adult life. It will be noticed that there were 6 cases over seventeen years of age, all in males. The following table shows the age and sex of each case:—

	Males.	Females.	Totals.
Under one year,	2	5	7
One year,	1	4	5
Two years,	5	4	9
Three years,	7	1	8
Four years,	5	3	8
Five years,	—	2	2
Six years,	2	1	3
Seven years,	5	1	6
Eight years,	2	—	2
Nine years,	1	1	2
Ten years,	1	1	2
Twelve years,	1	—	1
Thirteen years,	1	—	1
Fourteen years,	2	—	2
Fifteen years,	—	2	2
Sixteen years,	—	1	1
Seventeen years,	—	1	1
Eighteen years,	1	—	1
Nineteen years,	2	—	2
Twenty years,	1	—	1
Twenty-one years,	1	—	1
Twenty-two years,	1	—	1
Twenty-five years,	1	—	1
Totals,	42	27	69

NATIVITY.

The following data were obtained:—

Nativity.

	Massachusetts.	United States.	Foreign.	Not obtained
Father,	29	41	14	14
Mother,	29	44	17	8

Number of Birth.

	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	10th.	11th.	Not obtained.
Cases,	14	13	16	3	7	4	2	1	1	1	7

Interval of Time to Previous Confinement, in Years.

	1	2	3	4	5	6	7	10
Cases,	13	18	7	3	1	2	2	2

DISTRIBUTION OF PARALYSIS.

With the exception of the 6 abortive cases which showed no paralysis, the distribution of the paralysis was as follows:—

General,	3
Neck and back,	1
Right forearm,	1
Right arm,	4
Left arm,	2
Both arms and legs, neck and back,	1
Both arms, back, chest and throat,	1
Right arm and right leg,	3
Right arm and left leg,	2
Left arm and left leg,	2
Left arm, left thigh and leg,	1
Right arm, right thigh and leg,	1
Left arm and right upper arm,	1
Right leg,	2
Left leg,	2
Both legs,	11
Both legs and left arm,	2
Both legs, left arm and back,	1
Both legs and back,	1
Both legs, left arm and neck,	2
Both legs, neck and back,	1
Both legs and thighs,	8
Both legs, left face and left arm,	1
Left leg and thigh,	5
Right leg and thigh,	2
Right leg and thigh and left face,	2

SCHOOL.

As the outbreak occurred in July and August there were no results that could be attributed to school influences and but 3 of the children attended school.

WEATHER.

A study of the plotted curves of temperature, rainfall (secured from the report of the Hatch Experiment Station at Amherst) and the number of cases appears to show no correlation whatever.

LOCAL CONDITIONS.

Investigation of the home conditions of each case shows that the sanitary conditions were found to be excellent in 4 cases, good in 17, fair in 31 and bad in 17.

Forty-one of the cases lived in detached houses, 17 in two-tenement and three in three-tenement houses, while but 8 lived in houses having four or more tenements.

The elevation of the dwelling was noted as high in 28 cases, as medium in 22 and low in 19.

Forty-two of the houses were considered to be dry, while 27 were noted as being in a more or less damp location. There were cellars in all of the houses, 42 of which were dry and 23 were damp, while 4 were found to be very damp or wet.

The water supply was given as spring water in 53, as the town supply in 14 and from wells in but 2 cases.

The sanitary arrangements in the houses showed that 23 houses had water-closets connected with the sewer and 46 had earth closets; that the sink water from 30 houses was carried into the sewer and in 39 cases it was disposed of in various ways on the land near by or in pipes to the nearest brook, pond, etc.

Screens were found to be used in 65 cases and not used in but 4 cases. Inquiry into the question of flies and mosquitoes showed that flies were said to be numerous in 28 instances, few in 39 and not present in 2; that mosquitoes were said to be numerous in 22 instances, few in 44 and not present in 2. No history of insect bites at the time of illness was obtained.

SUMMARY.

We are dealing with groups of cases of an acute disease attacking children chiefly, but youth and adults frequently up to the age of twenty-five years, among the inhabitants of river valleys in sparsely settled communities, occurring during the summer months of a hot, dry season. The persons attacked lived chiefly in detached houses, and but 8 lived in houses or blocks of more than three tenements. Although the cause of the disease is not known, it can undoubtedly be classed as infectious.

as its distribution and incidence in localities are similar to those of other infectious diseases and strongly suggest a common cause.

Ninety per cent. of the persons attacked were in good health, and while a few instances of traumatism, overheating, fatigue and swimming were noted previous to the onset, the history of these cases does not seem to warrant the placing of much etiological responsibility upon these occurrences. They were not different from what might be found in the history of almost any groups of persons at this season.

With regard to the contagiousness of the disease the investigation of this group of cases suggests that the disease is but mildly contagious, to say the most. A large number of children were in intimate contact with those who were sick, and of these children an insignificant minority developed the disease. Although the group of cases investigated is a small one from which to draw generalizations, it must be remembered that the circumstances were particularly favorable to the investigation of points of contact between sick and well and of the detection of contagion.

The sanitary conditions under which most of the cases lived were not good. Dampness prevailed in many locations and most of the houses were very near water, but it must be remembered that the outbreak was in the valleys. Most of the houses had no sewer connection.

The marked digestive disturbances, which were early and notable symptoms, suggest the stomach as the port of entry for the infection. It does not seem possible in this outbreak to blame the varied sources of milk or water supply as carriers of the infection, unless it be considered that the cause of the disease may be present in all milk or in all water. That the cause may be connected with the food seems possible. It is important to note that none of the 7 infants under one year of age were fed exclusively upon breast milk.

The facts that all the cases living on the hill farms had been in the valley towns recently, where the infection may have occurred, and that many families purchased some of their food supplies from peddlers' carts, which act as the go-between between the town and the country, may be noteworthy.

It is not known what influences the dry season, with its low water and the proximity of many houses to water, contributes, but these facts appear to be significant.

CONCLUSIONS.

From an intimate acquaintance with all the facts and conditions of this outbreak we conclude that:—

1. Infantile paralysis is a disease produced by some external agent,—that is, it is an infectious disease.

2. It is mildly contagious at the most.

3. The harmful agent appears to enter the digestive tract in most instances.

4. Until the organism causing the disease is known, it will be impossible to say whether the infection is carried directly to the patient or by means of food.

